**Introduction**

Garden sheds, tools, lawn furniture, bicycles, cars and other items that are left outside can be quickly damaged by rust. The cost of the damage can add up to hundreds of dollars each year. A student decided to perform an investigation to find out whether certain conditions promote the rusting process.

**Big Question:** What conditions cause rust to form on an iron nail?

**Part A. The Control Procedure**

1. Lightly sand a nail to remove any protective coating that the manufacturer may have added.

2. Place the clean, dry iron nail into a clean, dry test tube.

3. Label the test tube “dry” and put it upright in the test tube rack.

4. Record observations.

5. Observe any changes in the nail every class for 4 classes.

**Part B. The Wet Nail Procedure**

**Question:** Will being wet with water cause more rusting in the iron nail than being dry?

**Rewrite the procedure to test this variable:**

**Materials**

Provide a 2 column list of all the materials that are required for all three parts of this lab.

**Designing Good Investigations**

1. Why is Part A, **the control procedure** crucial to the success of this experiment?

2. Scientists call the “cause” variable the **independent variable**. This is the one thing in the experiment that you purposely change. What is the **independent variable** for Part B of this experiment?

3. The “effect” variable is called the **dependent variable**. This is what you measure or observe during or at the end of your experiment. What is the **dependent variable** for Part B of this experiment?

4. A **controlled variable** is something that is kept constant throughout the experiment so that it does not influence the dependent variable. List **three** controlled variables for this experiment.

**Writing a Hypothesis**

The student conducting this experiment wrote six different hypotheses for **Part B.**  Circle the **best** hypothesis. For each of the other hypotheses write a sentence explaining why it is inappropriate. Remember that a good hypothesis should meet the following criteria:

* It should be testable
* The hypothesis should state a cause and effect relationship between the **independent variable** and the **dependent variable**.
* It should predict what will happen to the dependent variable as we change the independent variable.
* After conducting the experiment you should have some data that can support or reject your hypothesis.
* It should not be too general or vague

(1) Nails that are painted will rust more slowly than nails that are not painted.

(2) The rusty nails will turn brown.

(3) The nail placed in water will dissolve.

(4) A nail placed in salt water will have more rust than a nail placed in water.

(5) The dry nail placed in air will rust the most.

(6) The nail placed in water will rust more than the dry nail.

**Observations**

After two classes the student observed the following results.

**Part A: The nail placed in air had no rust.**

**Part B: The nail placed in water had no rust.**

**Conclusion**

A conclusion is a statement that indicates whether your results **support or reject** your hypothesis. **Never** use the word proved in a high school science conclusion. Write a conclusion for Part B and a conclusion for Part C in this experiment.

**Improvements**

What are three ways that Parts A and B of this lab could be improved?

**Part C. The Salt Water Nail Procedure**

**Question** Will being wet with salt water cause more rusting in an iron nail than being dry?

**1. Write a Hypothesis:**

**2. a) The Control Procedure**

1. Lightly sand a nail to remove any protective coating that the manufacturer may have added.

2. Place the clean, dry iron nail into a clean, dry test tube.

3. Label the test tube “dry” and put it upright in the test tube rack.

4. Record observations.

5. Observe any changes in the nail every class for 4 classes.

**b) Rewrite the procedure to test this variable:**

3. What is the independent variable for Part C of this experiment?

4. What is the dependent variable for Part C of this experiment?

5. List 3 controlled variables for this experiment.

6. Here are the observations for this experiment.

**Control Procedure: The nail placed in air had no rust.**

**Part C: The nail placed in salt water did have rust.**

Write a concluding statement for the Part C experiment.